

Advanced+ Boot Block World's First
0.18-Micron
Flash Memory

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Flash Products Group
April 17, 2000

Intel® Boot Block Flash Memory on 0.18μ Lithography

Why Are We Here?

- Intel is announcing that its high-volume Boot Block product line will migrate to 0.18μ lithography.

Agenda:

- **Market Environment**
- **Product Leadership**
- **Capacity Leadership**
- **Flash Investment Leadership**

Intel Boot Block Flash Memory on 0.18 μ Lithography

Flash Market Constrained

Plan on tight market for flash memory chips to continue through 2000.

-Purchasing, Jan 13, 2000

...[flash memory] Shortages are likely to get worse as demand is strong. Fifty-five percent of those surveyed report that their purchase orders will increase over the next 90 days...

[A]bout 21% say prices were rising in January

-Purchasing, Feb 10, 2000

STM puts all its product families on allocation.

...The company's flash memory supplies are seriously constrained. Despite plans to bring on additional capacity at several fabrication facilities, company executives said that STM's flash memory production is sold out for the whole of 2000...

-Electronic Engineering Times, 1/24/00

“...[flash memory] Leadtimes have stretched to 20 weeks, and undercapacity conditions will last well into 2000”, Jesse Huffman, senior analyst In-Stat.

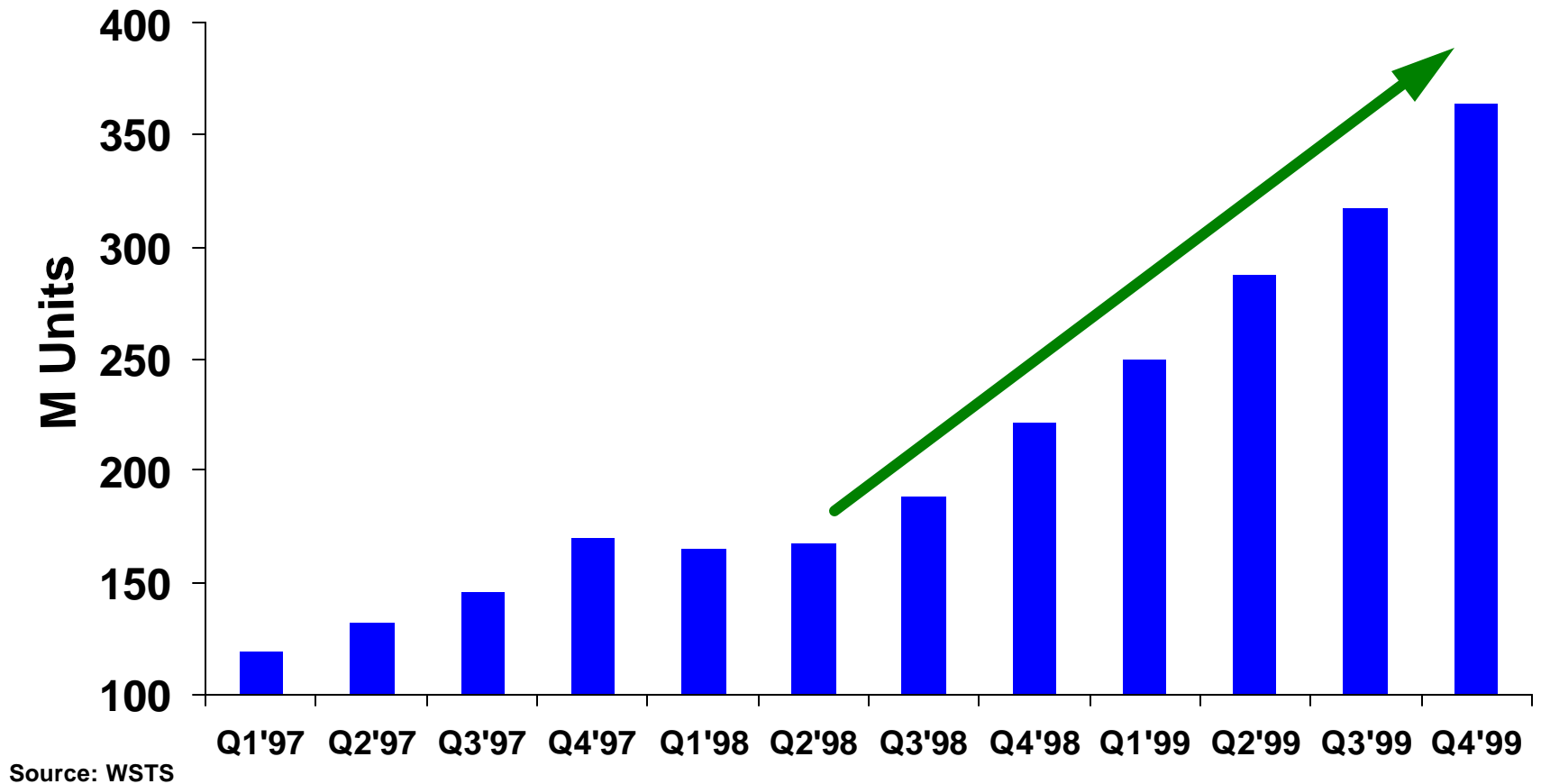
-Purchasing, Feb 10, 2000



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Flash Demand Surged Since Mid-1998

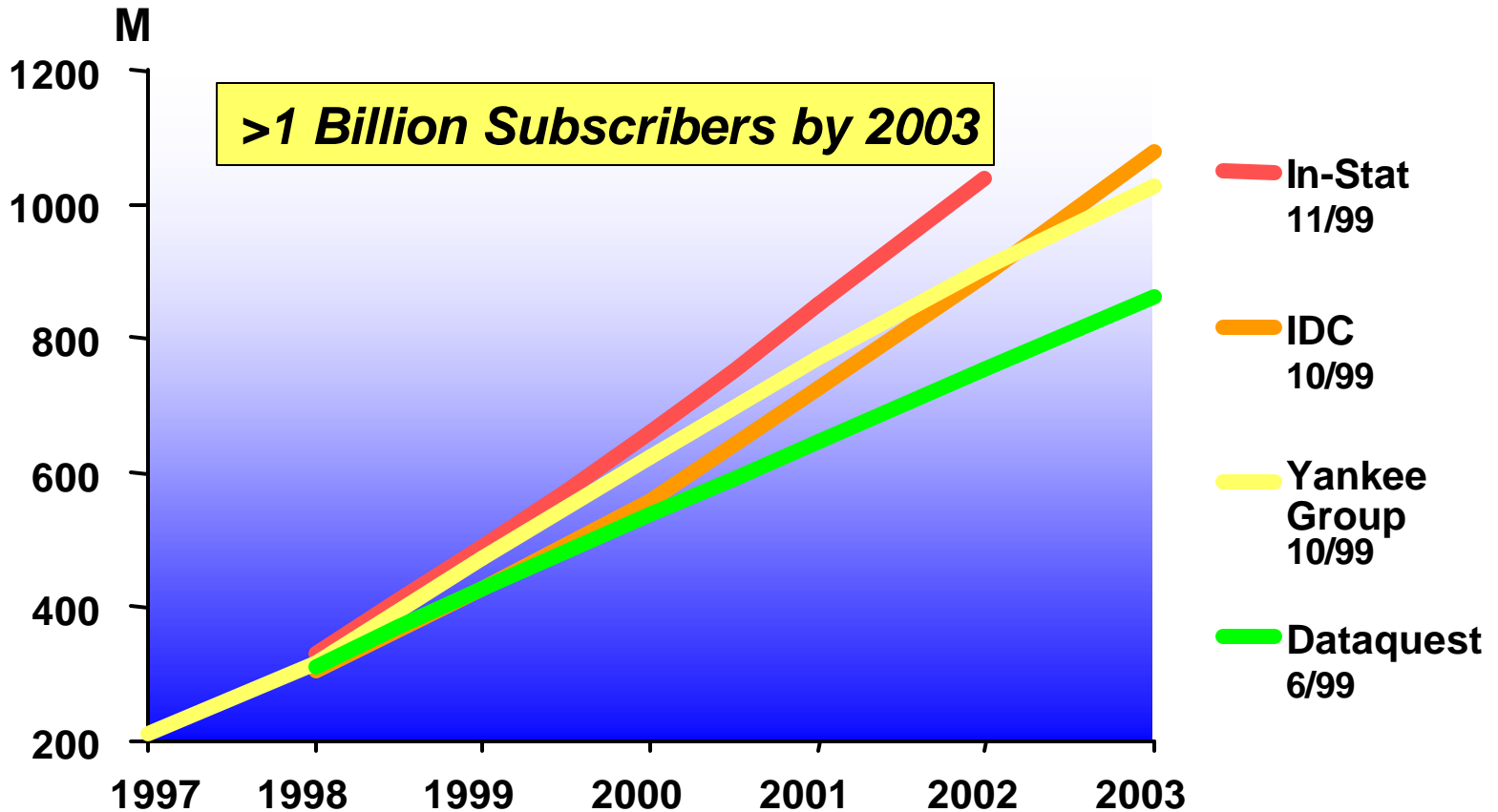


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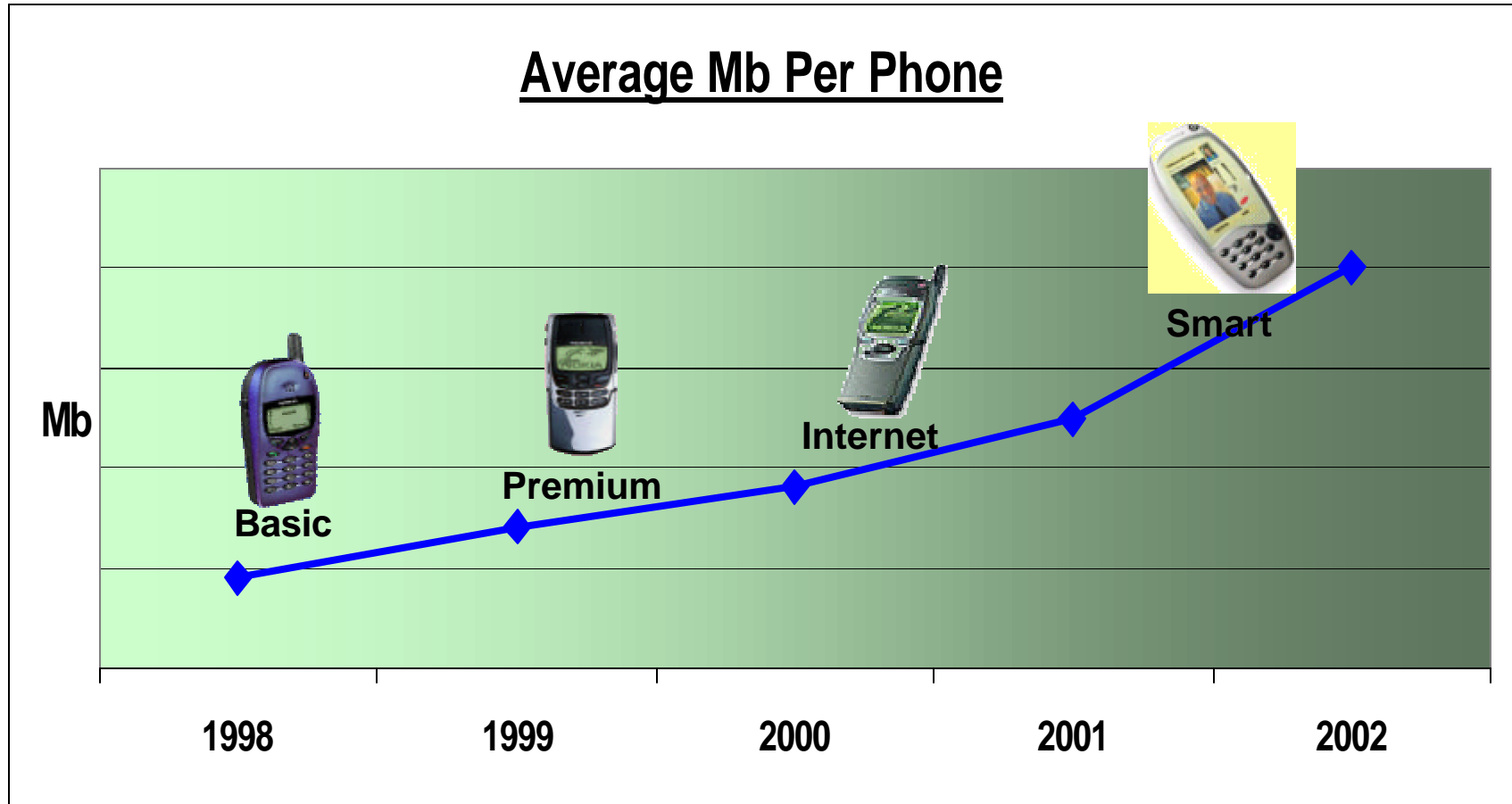
Intel Boot Block Flash Memory on 0.18 μ Lithography

Cellular Market a Huge Opportunity for Flash

Global Cellular Subscribers



Intel Boot Block Flash Memory on 0.18 μ Lithography Flash Cell Phone Flash Density Trends



Source: Intel Internal

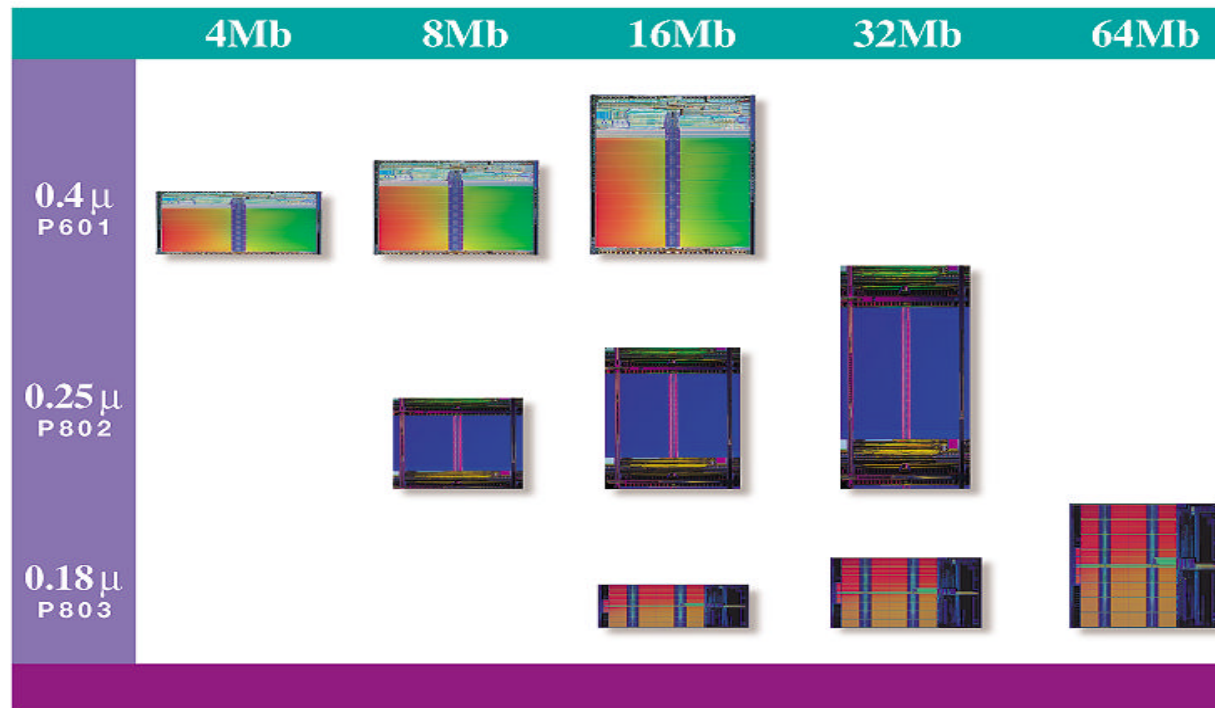
Wireless Internet Drives Density Up

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Announcing Intel Flash Memory on 0.18μ Flash Process Technology

New Processes Optimized
for Higher Density



12-18 Months Ahead of the Competition

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Flash Memory

Product Description

- **Flash:** Advanced and Advanced+ Boot Block (B3/C3)
 - Includes all Advanced+ Boot Block “Secure” Features
- **Density(s):**
 - 32Mbit
 - 16Mbit
 - 64Mbit
- 2.7-3.6V Operating Range
- 70ns speed
- x16 Architecture
- -40° C to +85° C Extended Temp Operation
- 0.18 μ Lithography (Flash)

Intel's 3rd Generation, backward compatible, Boot Block Product Family

Intel Boot Block Flash Memory on 0.18 μ Lithography

Product Schedules

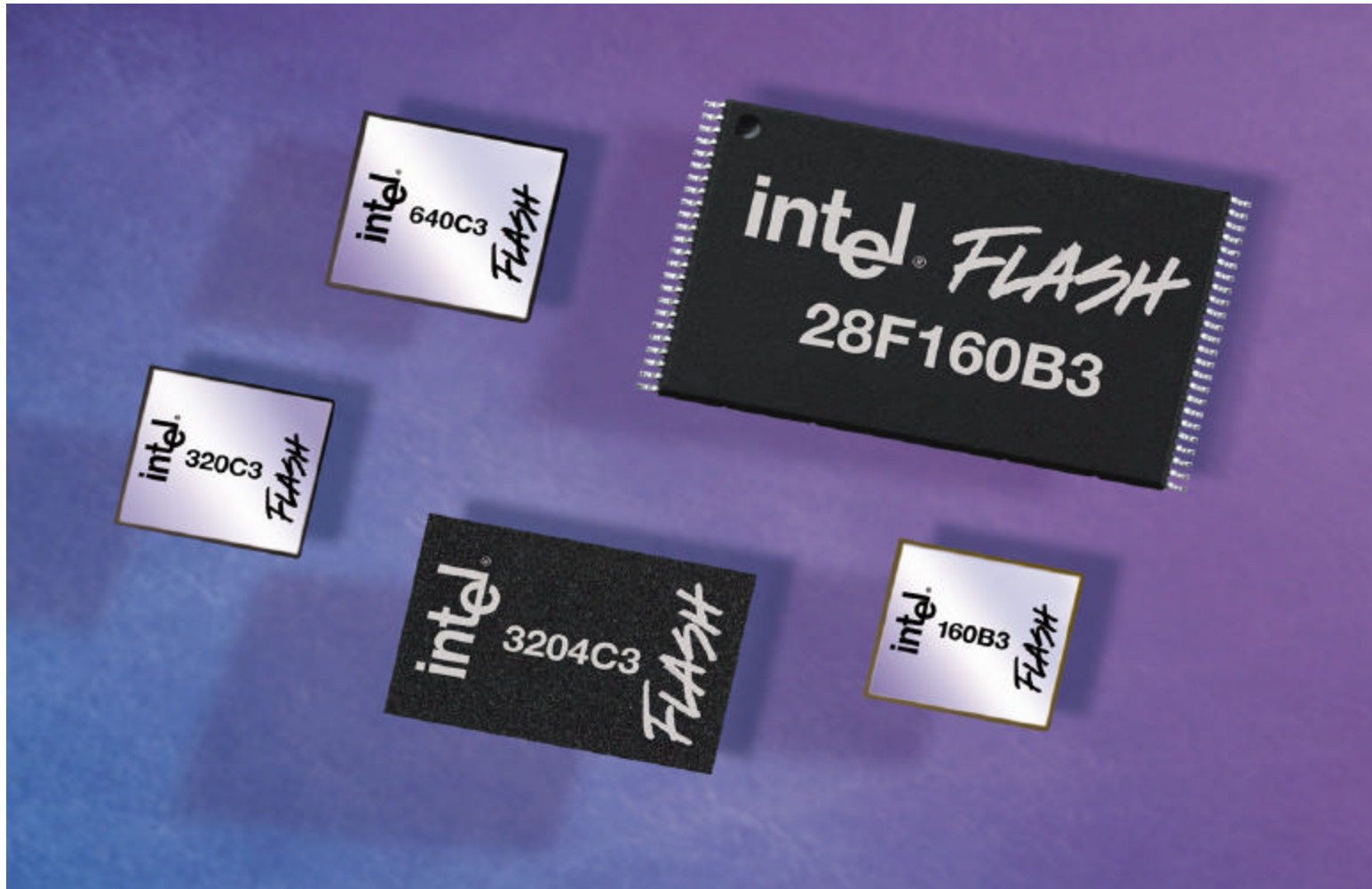
Product Schedules	32-Mbit	16-Mbit	64-Mbit
Initial Samples	Now	Feb'01	June'01
Production Samples	May'00	March'01	August'01
Production	Sept'00	April'01	Sept'01

32Mb Samples Shipping Now



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Intel Boot Block Flash Memory on 0.18 μ Lithography Packaging



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Flash Capacity Roadmap

Intel D2
Development Fab
Santa Clara, CA



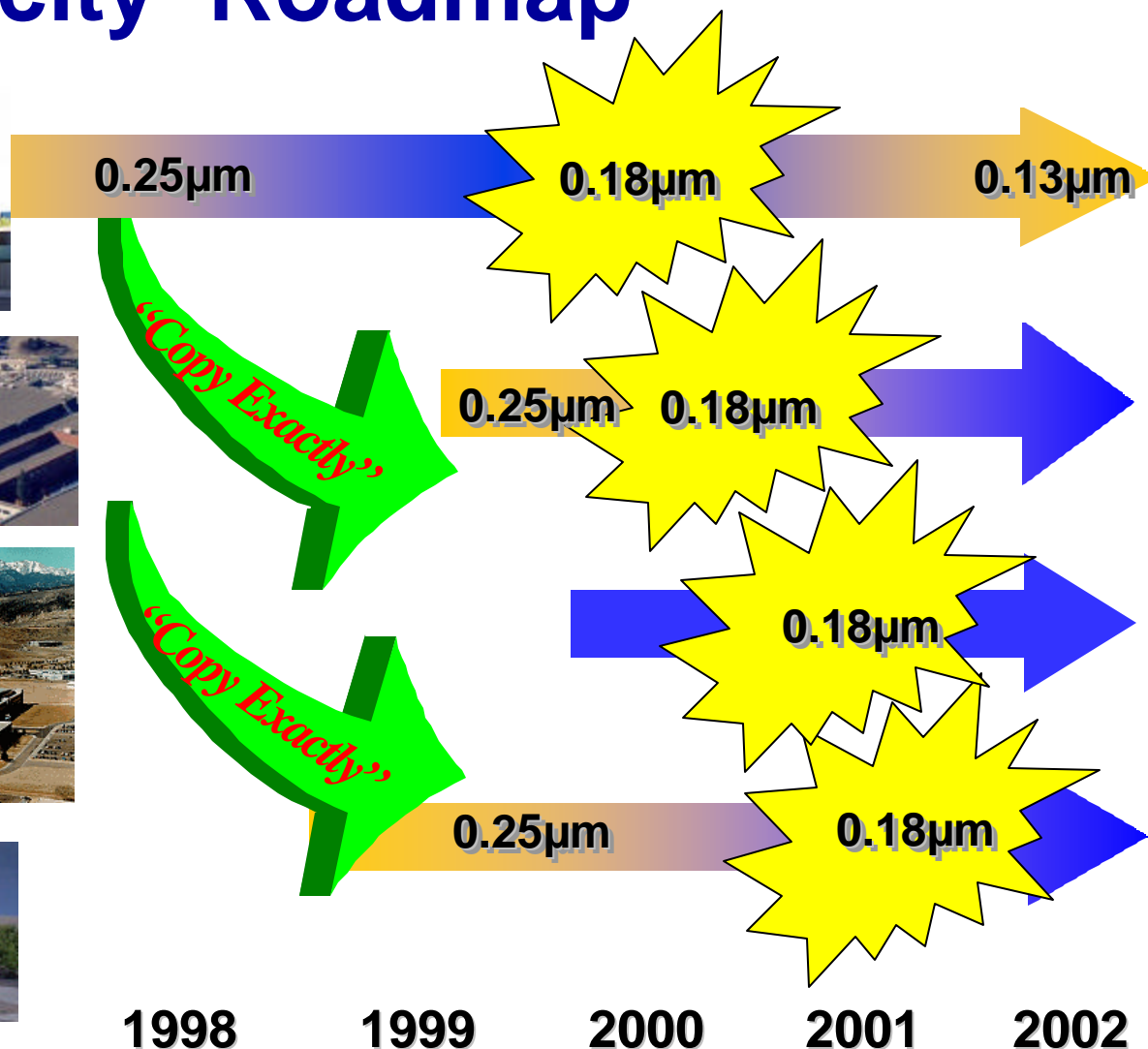
Intel Fab 15
Portland, OR



Intel Fab 23
Colorado
Springs, CO



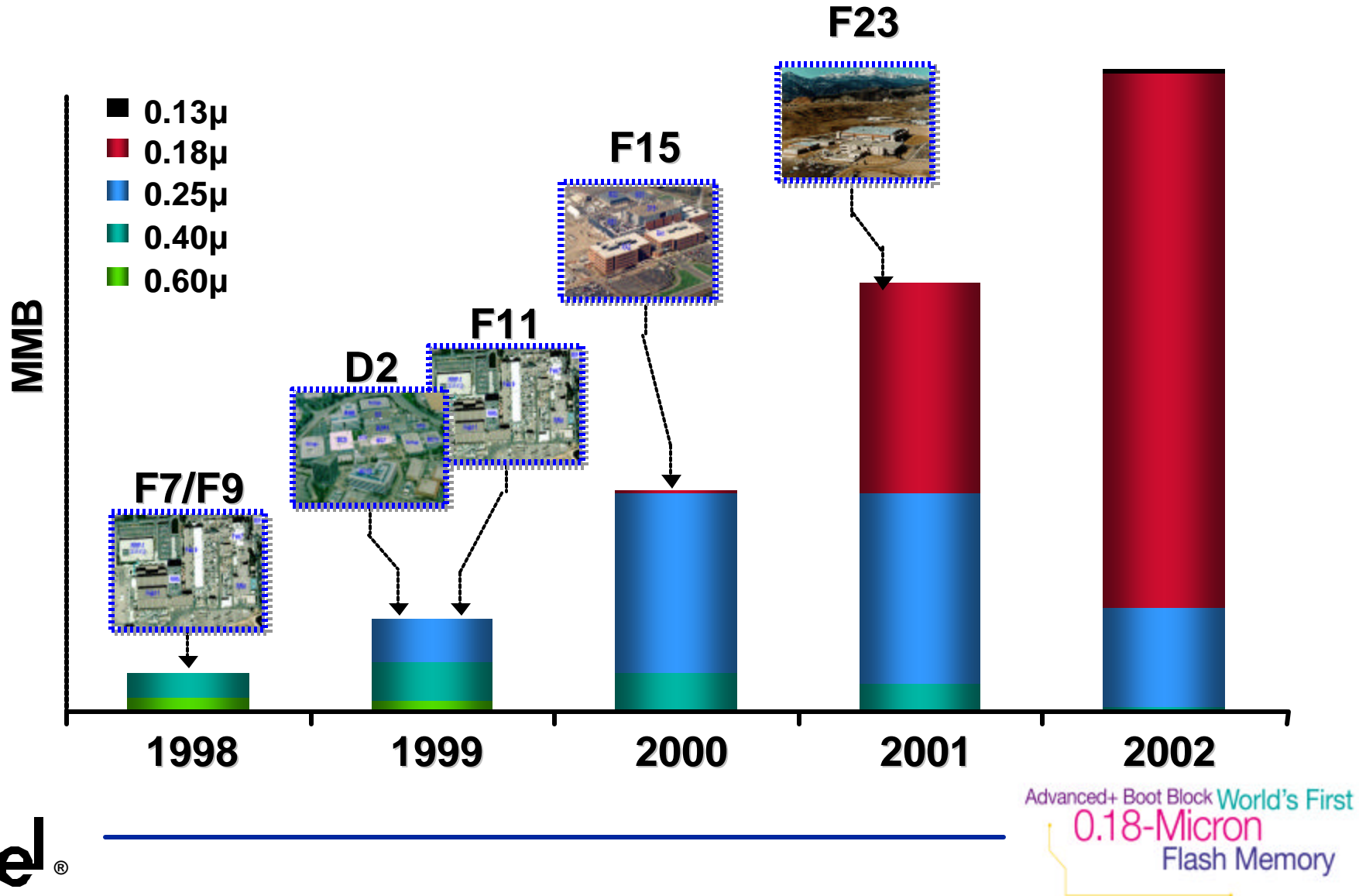
Intel Fab 11
Albuquerque,
NM



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Intel Boot Block Flash Memory on 0.18 μ Lithograph

Intel's \$2+ Billion Flash Investment



Summary

- **12-18 Months Technology Leadership With First Flash Memory on 0.18 μ Lithography**
 - 8X Flash Memory Capacity Growth 1999 thru 2002 (MMB)
 - Advanced Product Performance
- **World Class Flash Factory Network**
 - Investment Leadership: \$2+B Flash Investment
 - Newest additions = Fab23 in Colorado & Fab15 in Oregon
 - “Copy Exactly” for faster product ramp
- **Intel 3rd generation, backward compatible, Boot Block product family**

Appendix

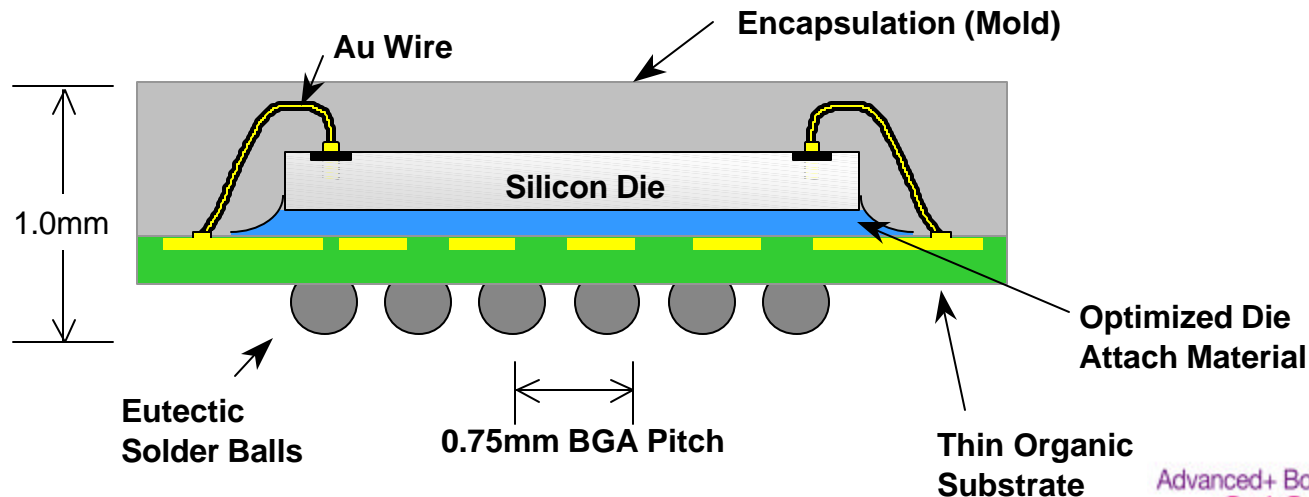


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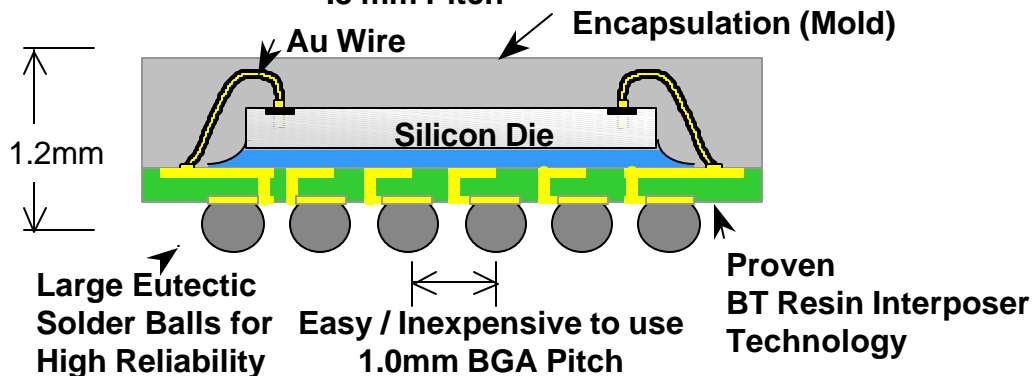
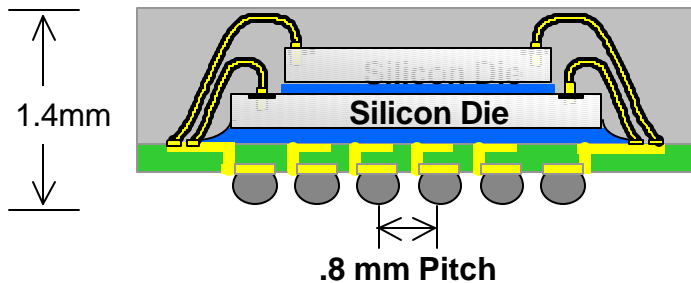
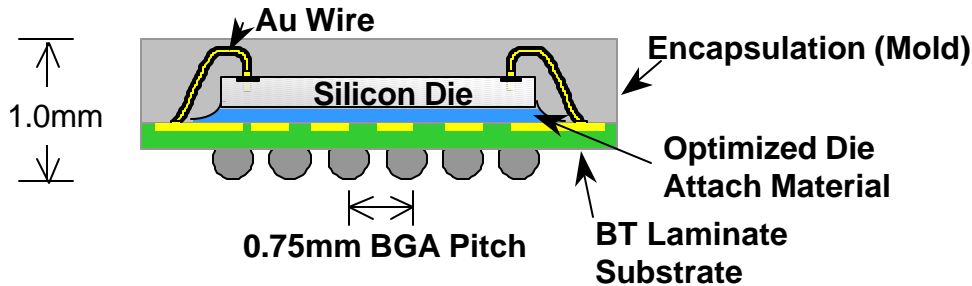
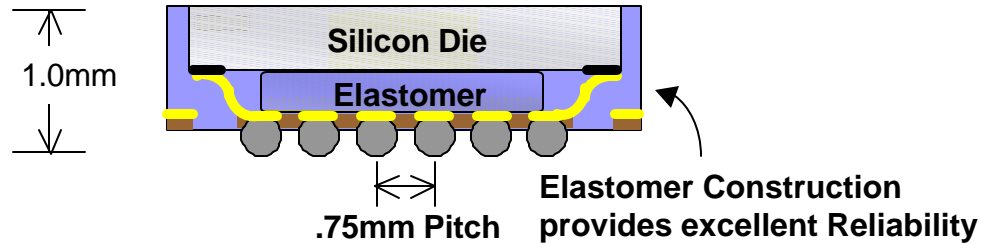
VF BGA Package

- Very-thin, Fine-pitch, Ball Grid Array package
 - Less than 1.0 mm thick
 - .75mm pitch
- Drop in replacement for μ BGA* package for low density / lithography shrinks
 - Same JEDEC Standard as μ BGA Package: MO-207-B

*New in
2000 !*



Intel® CSP Offerings



- **μBGA* CSP / VF BGA**

- Smallest and most reliable discrete flash solution
- VF BGA: Drop in replacement for μBGA* package
- JEDEC Standard: MO-207-B

- **Stacked - CSP (S-CSP)**

- Smallest integrated flash + SRAM solution
- JEDEC Standard: MO-11-540

- **Easy BGA**

- Low cost easy implementation
- Footprint compatibility for extended product life cycles
- JEDEC Standard: MO-216-A

Intel Boot Block Flash Memory on 0.18 μ Lithography

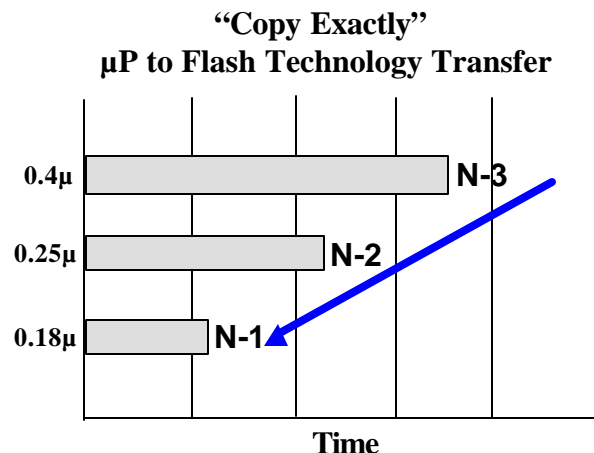
Intel's "Copy Exactly"



"Development of Intel's microprocessors and flash memories is guided by our "Copy Exactly" methodology, which is a system that cross-pollinates key learning's across products and factories.

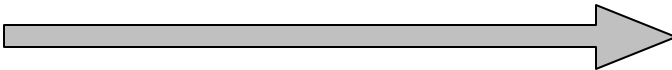
This system allows Intel's flash memories to constantly take advantage of leading-edge technology for density and overall performance."

Gordon Moore,
November 10th, 1999



Intel Boot Block Flash Memory on 0.18 μ Lithography

Product Overview

Specs	32-Mbit		64-Mbit		16-Mbit	
	C3	B3	C3	B3	C3	B3
Packaging	<ul style="list-style-type: none"> • 48-VF BGA • 48-TSOP • EBGA • SCSP 	<ul style="list-style-type: none"> • 48-VF BGA • 48-TSOP 	<ul style="list-style-type: none"> • 48-VF BGA • 48-TSOP • EBGA • SCSP 	<ul style="list-style-type: none"> • 48-VF BGA • 48-TSOP 	<ul style="list-style-type: none"> • 48-VF BGA • 48-TSOP • EBGA • SCSP 	48-VF BGA 48-TSOP
Power:						
<ul style="list-style-type: none"> • Vcc • Vpp • Vccq 	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV	2.7-3.6V R&W 2.7-3.6V / 12V 1.8V +/-150mV
Performance:						
<ul style="list-style-type: none"> • 2.7-3.6V 	80ns	80ns	90ns	90ns	70ns	90ns
Architecture: <ul style="list-style-type: none"> • 8ea 4k Word Data Blocks, 32K Word Main Blocks • x16 Architecture • Top & Bottom Boot • Extended Temperature (-40°C to +85°C) 						
128-Bit OTP	Y	N/A	Y	N/A	Y	N/A
Instant Individual Block Locking	Y	N/A	Y	N/A	Y	N/A

Intel Boot Block Flash Memory on 0.18 μ Lithography

Features & Benefits

Features	Benefits
<ul style="list-style-type: none">On Intel's 0.18 micron lithography process	<ul style="list-style-type: none">The world's most advanced Flash Memory technologyIncreased availability from Intel's "Copy Exactly" factory network
<ul style="list-style-type: none">High Performance	<ul style="list-style-type: none">70ns Max Access Time @ 2.7V-3.6V
<ul style="list-style-type: none">16-, 32-, and 64-Mbit densities	<ul style="list-style-type: none">Full range of easy-to-upgrade, pin compatible densitiesOn the world's most advanced lithography process
<ul style="list-style-type: none">TSOP, BGA and Stacked-Chip Scale Packaging	<ul style="list-style-type: none">Industry-standard JEDEC packagingProven package reliabilityBGA and Stacked-CSP flash for space constrained applications.
<ul style="list-style-type: none">Instant Individual Block Locking128-bit Fraud Protection RegisterImproved production programming	<ul style="list-style-type: none">Insures immediate data protection for individual blocksUnique ID and OTP enables fraud protection capabilitiesReduces system logic to enable high-speed production programming
<ul style="list-style-type: none">Flash Data Integrator (FDI)	<ul style="list-style-type: none">Most cost effective, and flexible code + data solutionEliminates need for additional EEPROM deviceEnables data streaming capabilities (voice, fax, and e-mail)

P803 B3/C3: Read Access Time Improvements

Spec	P802 @ 2.7V		P803 @ 2.7V	
	16M	32M	16M	32M
t_{AVAV}	90ns	100ns	70ns	80ns
t_{AVQV}	90ns	100ns	70ns	80ns
t_{ELQV}	90ns	100ns	70ns	80ns
t_{GLQV}	30ns	30ns	20ns	20ns

20ns Improvement

P803 B3/C3: Power Consumption Improvements

Spec	P802 @ 2.7V-3.6V	P803 @ 2.7V-3.6V
I _{ccs}	18μA typ	7μA typ
	35μA max	15μA max
I _{ccd}	7μA typ	7μA typ
	20μA max	15μA max
I _{ccr}	10mA typ	9mA typ
	18mA max	18mA max
V _{cc}	16M: V _{cc(max)} = <u>3.6V</u>	32M/64M: V _{cc(max)} = <u>3.3V</u>

← Improvement to 3.6V in Progress

> 60% Improvement in Standby Current

P803 B3/C3: Program Time Specifications

Spec	P802 @ 2.7V-3.6V	P803 @ 2.7V-3.6V
Word Program time	22μs typ	12μs typ
	200μs max	200μs max

45% Improvement in Program Time

Fraud Protection Register

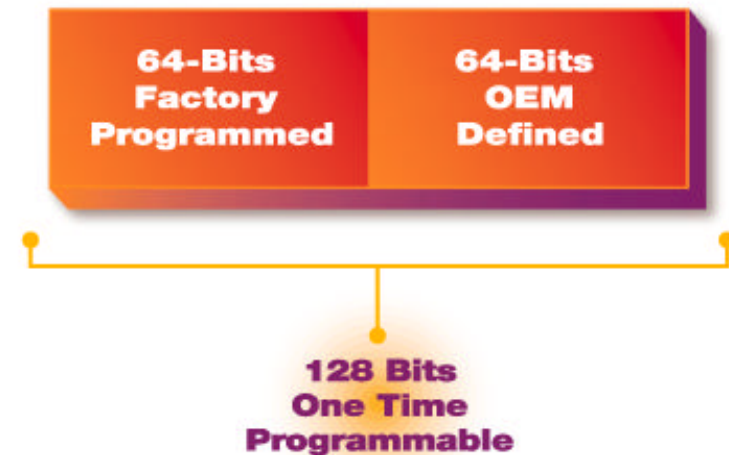
- **Enables Added System Security Features**

- **One Time Programmable (OTP) Bits (128 bits)**

- » 64 bits Programmed by Intel
- » 64 bits Programmable by Customer

- **Can Be Used for:**

- » System Authentication, Platform Configuration
- » Fraud Protection
- » Any Other Security Scheme That Uses OTP Bits



Instant Flex Block Locking

- **Improved Code and Data Integrity**

- **Instant: Zero Latency Locking**

- » Code and/or Data Is Instantly Protected Once the Lock Block Command Is Issued

- **Flexible: Can Lock/Unlock Any Block**

- » Store Boot Code Outside Parameter Blocks

- » Protect Data, Such As Parameter Tables or Multiple Language Fonts



Lockdown Locked Unlocked

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